

What is Claimed is:

1 1. In an air/ground communication environment in which a control site
2 communicates with a plurality of aircraft via a plurality of ground stations, wherein each of
3 the plurality of aircraft is in radio communication with at least one of the plurality of ground
4 stations, and the plurality of ground stations and the plurality of aircraft share a common
5 air/ground communication channel, a method of allocating transmission time slots to the
6 plurality of ground stations, the method comprising:

7 (a) building a transmission time slot schedule containing a transmission time slot
8 allocation for at least one of the plurality of ground stations; and

9 (b) distributing the transmission time slot schedule from the control site to at least one
10 of the plurality of ground stations;

11 wherein a ground station that receives a time slot allocation assumes management
12 over use of transmission time slots allocated to the ground station by the transmission time
13 slot schedule.

1 2. The method of claim 1, wherein the transmission time slot schedule allocates VDL
2 management time slots.

1 3. The method of claim 1, wherein a count of transmission time slots allocated to one
2 of the plurality of ground stations in the transmission time slot schedule is based, at least in
3 part, upon a count of the plurality of ground stations.

1 4. The method of claim 1, wherein a count of transmission time slots allocated to one
2 of the plurality of ground stations in the transmission time slot schedule is based, at least in
3 part, upon a count of aircraft for which said one of the plurality of ground stations has polling
4 authority.

1 5. The method of claim 1, wherein a count of transmission time slots allocated to one
2 of the plurality of ground stations in the transmission time slot schedule is based, at least in
3 part, upon a volume of communication traffic supported by said one of the plurality of ground
4 stations.

1 6. The method of claim 1, wherein the control site periodically rebuilds and
2 redistributes the transmission time slot schedule to at least one of the plurality of ground
3 stations.

1 7. In an air/ground communication environment in which a control site
2 communicates with a plurality of aircraft via a plurality of ground stations, a method of
3 managing a plurality of unique aircraft addresses for assignment to the plurality of aircraft,
4 wherein each of the plurality of aircraft is in radio communication with at least one of the
5 plurality of ground stations, the method comprising:

6 (a) maintaining, at the control site, an information base containing the plurality of
7 unique aircraft addresses and status information associated with each of the plurality of
8 unique aircraft addresses;

9 (b) delegating authority to assign at least one of the plurality of unique aircraft
10 addresses from the control site to at least one of the plurality of ground stations; and

11 (c) updating at the control site the status information associated with each of the
12 plurality of unique aircraft addresses based upon information contained in a message received
13 from at least one of the plurality of ground stations.

1 8. The method of claim 7, wherein the control site revokes authority of a ground
2 station to assign one or more unique aircraft addresses based upon status information
3 maintained at the control site.

1 9. The method of claim 8, wherein the status information maintained at the control
2 site includes at least one of:

3 an identifier of a ground station to which a unique aircraft address is delegated;

4 an indicator that indicates whether a unique aircraft address has been assigned to an
5 aircraft; and

6 a count of unassigned unique aircraft addresses delegated to each ground station.

1 10. The method of claim 7, wherein upon the control site transferring responsibility
2 for polling an aircraft, with an assigned unique address, from a first ground station to a
3 second ground station, the control site also transfers authority over the assigned unique
4 address from the first ground station to the second ground station.

1 11. The method of claim 7, further comprising:

2 (d) maintaining, at a ground station, an information base containing a unique aircraft
3 address delegated to the ground station by the control site and status information associated
4 with the unique aircraft address; and

5 (e) updating the status information associated with the unique aircraft address within
6 the ground station information base to reflect assignment of the unique aircraft address to an
7 aircraft by the ground station.

1 12. In an air/ground communication environment in which a control site
2 communicates with a plurality of aircraft via a plurality of ground stations, a method of
3 coordinating a handover of responsibility for periodically polling one of said plurality of
4 aircraft from a first ground station to a second ground station, comprising:

5 (a) receiving at the control site a poll response report from the first ground station and
6 a poll response report from the second ground station, wherein each of the poll response
7 reports contains a time of arrival (TOA) of a poll response at each of the first and second
8 ground stations, respectively;

9 (b) transmitting a handover command from the control site to the first ground station
10 and the second ground station that transfers polling responsibility from the first ground
11 station to the second ground station based upon an assessment by the control site of TOA
12 values contained in the respective poll response reports.

1 13. A method of claim 12, wherein the poll response report generated by the first
2 ground station and the poll response report generated by the second ground station are
3 generated in response to receipt of a poll response transmitted by the aircraft in response to a
4 poll request transmitted by the first ground station.

1 14. A method of claim 12, wherein in step (b) the assessment by the control site
2 includes a calculation based upon the TOA values.

1 15. In an air/ground communication environment in which a control site
2 communicates with a plurality of aircraft via a plurality of ground stations, a method of
3 selecting a ground station from the plurality of ground stations to transmit a message to a
4 uniquely identified aircraft, the method comprising:

5 (a) receiving at the control site from at least one of the plurality of ground stations a
6 message that includes at least one of a ground station identifier, a unique aircraft identifier, a
7 unique message identifier, a signal time of arrival (TOA) at the receiving ground station and
8 signal quality information, as determined by the receiving ground station;

9 (b) storing in an information base at the control site at least one of the ground station
10 identifier, the unique aircraft identifier, the unique message identifier, the signal TOA at the
11 receiving ground station and the signal quality information contained in the message received
12 at the control site; and

13 (c) selecting a preferred ground station for use by the control site to transmit signals
14 to or to receive signals from a specific aircraft based upon information contained in the
15 information base.

1 16. The method of claim 15, the steps further comprising:

2 (d) storing an identifier for the ground station, selected for use by the control site to
3 transmit signals to or receive messages from a specific aircraft, in the control site information
4 base.

1 17. The method of claim 15, the steps further comprising:

2 (e) periodically reselecting the ground station, based upon updated information
3 contained in the information base, and storing the identifier for the selected ground station in
4 the control site information base.

1 18. In an air/ground communication environment in which a control site
2 communicates with a plurality of aircraft via a plurality of ground stations, a method of
3 scheduling air to ground data communication from the plurality of aircraft to the control site,
4 the method comprising:

5 (a) receiving at the control site an inbound data slot request from one of the plurality
6 of aircraft via one of the plurality of ground stations;

7 (b) storing in an information base at the control site information received in a
8 plurality of inbound data slot requests;

9 (c) assessing at the control site information stored in the information base received in
10 the plurality of inbound data slot requests; and

11 (d) transmitting, based upon the assessment, an inbound reservation from the control
12 site to a specific aircraft via one of the plurality of ground stations that identifies a time slot
13 that the aircraft is permitted to use to transmit data to the control site via the plurality of
14 ground stations.

1 19. The method of claim 18, wherein the information base contains information
2 pertaining to each inbound data slot request received, the information including at least one
3 of:

- 4 a unique identifier of the aircraft making the request; and
- 5 a priority associated with the data to be transmitted.

1 20. The method of claim 18, wherein step (c) includes a consideration of at least one
2 of:

- 3 a number of pending inbound data requests;
- 4 a priority of pending inbound data requests;
- 5 a volume of pending outbound data; and
- 6 a priority of the pending outbound data.

1 21. In an air/ground communication environment in which a control site
2 communicates with a plurality of aircraft via a plurality of ground stations, a method of
3 selecting an air to ground communication signal originating from one of the plurality of
4 aircraft and received by more than one of the plurality of ground stations, the method
5 comprising:

- 6 (a) receiving at a plurality of ground stations an incoming signal;
- 7 (b) relaying from each of the plurality of ground stations the signal, a time of arrival
8 (TOA) of the incoming signal at the ground station, and signal quality information
9 determined by the ground station, to the control site;
- 10 (c) determining at the control site, based upon TOA and incoming signal quality
11 information, a preferred ground station via which to receive the incoming signal; and

12 (d) forwarding the incoming signal received from the preferred ground station to a
13 control site communication switch.

1 22. The method of claim 21, wherein in step (c) the preferred ground station via
2 which to receive the incoming signal is the ground station with the earliest signal TOA and a
3 signal that meets a set of minimum signal quality requirements.

1 23. An air/ground communication system that supports communication with a
2 plurality of aircraft, the system comprising:

3 a plurality of ground stations, wherein each of the plurality of aircraft is in radio
4 communication with at least one of the plurality of ground stations and wherein the plurality
5 of aircraft share a common air/ground communication channel with the plurality of ground
6 stations;

7 a control site, in communication with the plurality of ground stations, that allocates a
8 plurality of time slots used by the plurality of ground stations to share the common air/ground
9 communication channel and to support communication between the plurality of aircraft and
10 the control site.

1 24. The system of claim 23, wherein the control site builds a transmission time slot
2 schedule containing a transmission time slot allocation for at least one of the plurality of
3 ground stations and distributes the transmission time slot schedule to at least one of the
4 plurality of ground stations; and

5 wherein a ground station that receives a time slot allocation assumes management
6 over use of transmission time slots allocated to the ground station by the transmission time
7 slot schedule.

1 25. The system of claim 23, wherein the control site maintains an information base
2 containing a plurality of unique aircraft addresses and status information associated with each
3 of the plurality of unique aircraft addresses;

4 wherein the control site delegates authority to assign at least one of the plurality of
5 unique aircraft addresses to at least one of the plurality of ground stations; and

6 wherein the control site updates the status information associated with each of the
7 plurality of unique aircraft addresses based upon information contained in a message received
8 from at least one of the plurality of ground stations.

1 26. The system of claim 23, wherein the control site receives a poll response report
2 from a first ground station and a poll response report from a second ground station, wherein
3 each of the poll response reports contains a time of arrival (TOA) of a poll response at each
4 of the first and second ground stations, respectively;

5 wherein the control site transmits a handover command, to the first ground station and
6 to the second ground station, that transfers polling responsibility from the first ground station
7 to the second ground station based upon an assessment by the control site of TOA values
8 contained in the respective poll response reports.

1 27. The system of claim 23, wherein the control site receives from at least one of the
2 plurality of ground stations a message that includes at least one of a ground station identifier,
3 a unique aircraft identifier, a unique message identifier, a signal time of arrival (TOA) at the
4 receiving ground station and signal quality information, as determined by the receiving
5 ground station; and

6 wherein the control site selects a preferred ground station for use by the control site to
7 transmit signals to or to receive signals from a specific aircraft based upon the information
8 received.

1 28. The system of claim 23, wherein the control site receives an inbound data slot
2 request from one of the plurality of aircraft via one of the plurality of ground stations; and

3 wherein the control site transmits, based at least in part upon an assessment of the data
4 slot request received, an inbound reservation to a specific aircraft via one of the plurality of
5 ground stations that identifies a time slot that the aircraft is permitted to use to transmit data
6 to the control site via the plurality of ground stations.

1 29. The system of claim 23, wherein more than one of the plurality of ground stations
2 receives a signal originating from one of the plurality of aircraft;

3 wherein each of the plurality of ground stations receiving the signal relays the signal,
4 a time of arrival (TOA) of the incoming signal at the ground station, and signal quality
5 information determined by the ground station, to the control site;

6 wherein the control site determines, based upon TOA and incoming signal quality
7 information, a preferred ground station via which to receive the incoming signal; and

8 wherein the control site permits the preferred ground station to forward the incoming
9 signal received to a control site communication switch.

1 30. An air/ground communication system that supports communication between a
2 control site and a plurality of aircraft, the system comprising:

3 a plurality of ground stations, wherein each of the plurality of aircraft is in radio
4 communication with at least one of the plurality of ground stations and wherein the plurality
5 of aircraft share a common air/ground communication channel with the plurality of ground
6 stations;

7 wherein the control site, in communication with the plurality of ground stations,
8 allocates a plurality of time slots used by the plurality of ground stations to share the common
9 air/ground communication channel and to support communication between the plurality of
10 aircraft and the control site.

1 31. The system of claim 30, wherein at least one of the plurality of ground stations
2 receives a transmission time slot schedule from the control site containing a transmission
3 time slot allocation for at least one of the plurality of ground stations; and

4 wherein a ground station that receives a time slot allocation assumes management
5 over use of transmission time slots allocated to the ground station by the transmission time
6 slot schedule.

1 32. The system of claim 30, wherein at least one of the plurality of ground stations is
2 delegated authority from the control site to assign at least one of a plurality of unique aircraft
3 addresses;

4 wherein at least one of the plurality of ground stations maintains a local information
5 base containing the plurality of delegated unique aircraft addresses and status information
6 associated with at least one of the plurality of delegated unique aircraft addresses;

7 and

8 wherein at least one of the plurality of ground stations delegated unique aircraft
9 addresses updates the status information associated with at least one of the plurality of unique
10 aircraft addresses and sends a corresponding update message to the control site.

1 33. The system of claim 30, wherein at least one of the plurality of ground stations
2 sends a poll response report to the control site upon receiving a poll response from an aircraft
3 wherein the poll response report contains a time of arrival (TOA) of a poll response at the
4 ground station; and

5 wherein a ground station receives a handover command from the control site based
6 upon an assessment of TOA values contained in the poll response reports received.

1 34. The system of claim 30, wherein at least one of said plurality of ground stations
2 upon receiving a message from an aircraft relays the received message to the control site and
3 includes within the relayed message at least one of an identifier for the ground station, a
4 unique aircraft identifier, a unique message identifier, and a signal time of arrival (TOA) at
5 the receiving ground station and signal quality information, as determined by the receiving
6 ground station.

1 35. The system of claim 30, wherein a ground station relays an inbound data slot
2 request from an aircraft to the control site; and

3 wherein the ground station receives and relays an inbound reservation from the
4 control site to the aircraft that identifies a time slot that the aircraft is permitted to use to
5 transmit data to the control site via the plurality of ground stations.

1 36. The system of claim 30, wherein at least one of the plurality of ground stations
2 receives a signal originating from one of the plurality of aircraft;

3 wherein each of the plurality of ground stations receiving the signal relays the signal,
4 a time of arrival (TOA) of the incoming signal at the ground station, and signal quality
5 information determined by the ground station, to the control site;

6 wherein a preferred ground station, selected by the control site based upon the relayed
7 TOA and incoming signal quality information, is permitted to forward the incoming signal
8 received to a control site communication switch.

1 37. An air/ground communication system that supports communication with a
2 plurality of aircraft via a plurality of ground stations, wherein each of the plurality of aircraft
3 is in radio communication with at least one of the plurality of ground stations and wherein the
4 plurality of aircraft share a common air/ground communication channel with the plurality of
5 ground stations, the system comprising:

6 a control site, in communication with the plurality of ground stations, that allocates
7 time slots used by the plurality of ground stations to share the common air/ground
8 communication channel and coordinate communication between the plurality of aircraft and
9 the control site.

1 38. The system of claim 37, wherein the control site builds a transmission time slot
2 schedule containing a transmission time slot allocation for at least one of the plurality of
3 ground stations and distributes the transmission time slot schedule to at least one of the
4 plurality of ground stations.

1 39. The system of claim 37, wherein the control site maintains an information base
2 containing a plurality of unique aircraft addresses and status information associated with each
3 of the plurality of unique aircraft addresses;

4 wherein the control site delegates authority to assign at least one of the plurality of
5 unique aircraft addresses to at least one of the plurality of ground stations; and

6 wherein the control site updates the status information associated with each of the
7 plurality of unique aircraft addresses based upon information contained in a message received
8 from at least one of the plurality of ground stations.

1 40. The system of claim 37, wherein the control site receives a poll response report
2 from a first ground station and a poll response report from a second ground station, wherein
3 each of the poll response reports contains a time of arrival (TOA) of a poll response at each
4 of the first and second ground stations, respectively;

5 wherein the control site transmits a handover command, to the first ground station and
6 to the second ground station, that transfers polling responsibility from the first ground station
7 to the second ground station based upon an assessment by the control site of TOA values
8 contained in the respective poll response reports.

1 41. The system of claim 37, wherein the control site receives from at least one of the
2 plurality of ground stations a message that includes at least one of a ground station identifier,
3 a unique aircraft identifier, a unique message identifier, a signal time of arrival (TOA) at the
4 receiving ground station and signal quality information as determined by the receiving
5 ground station; and

6 wherein the control site selects a preferred ground station for use by the control site to
7 transmit a signal to or to receive a signal from a specific aircraft based upon the information
8 received.

1 42. The system of claim 37, wherein the control site receives an inbound data slot
2 request from one of the plurality of aircraft via one of the plurality of ground stations; and

3 wherein the control site transmits, based at least in part upon an assessment of the data
4 slot request received, an inbound reservation to a specific aircraft via one of the plurality of
5 ground stations that identifies a time slot that the aircraft is permitted to use to transmit data
6 to the control site via the plurality of ground stations.

1 43. The system of claim 41, wherein the control site selects a preferred ground station
2 based upon TOA and incoming signal quality information to forward an incoming signal
3 received to a control site communication switch.